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SHUICHI KANNO

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CROWELL & MORING LLP
P.O. Box 14300
Washington, DC 20044-4300

EXAMINER

NGUYEN, NGOC YEN M

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

DETAILED ACTION

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 40-43, 45-46, 48-49, 51, 79-86 are rejected under 35 U.S.C. 103(a) as obvious over Rossin et al (6,069,291) in view of Nguyen et al (5,283,041), optionally further in view of Okazake et al (5,151,263) and Imamura (5,649,985).

Rossin '291 discloses a process for the decomposition of perfluoroalkanes to HF and CO₂ (note claim 1). The process comprises contacting the perfluoroalkanes with aluminum oxide. The perfluoroalkane is contacted with aluminum oxide at a temperature ranging from about 400°C to about 1000°C, or preferably from about 550°C to 800°C (note column 2, lines 55-65). This range is well within the claimed range. The decomposition temperature of C₂F₆ is 750°C (note Example 1. This value is well within the claimed range.

Rossin '291 discloses that perfluoroalkanes are CF₄, C₂F₆, etc. (Note column 1, lines 25-28). Rossin '291 discloses, in Example XIX, a concentration of 5,000 ppm (= 0.5%) tetrafluoromethane (CF₄) in the gas to be treated. This value is well within the claimed range. For the other values of the claimed range, Rossin '291 does not disclose any limit for the concentration of the perfluoroalkanes in the gas to be treated. Thus, it would have been obvious to one of ordinary skill in the art to use the process of Rossin '291 to treat any exhaust gas, which contains perfluoroalkanes, especially when

the gas was generated during electrolytic aluminum smelting, during tetrafluoroethylene manufacture, and during semiconductor manufacture (note column 3, lines 48-54).

The aluminum oxide is stabilized, for example, with an element selected from the group consisting of barium, calcium, nickel among others (note sentence bridging columns 2-3). The catalyst is formed by slurring pseudoboehmite aluminum oxide (which is encompassed by the claimed "boehmite") in an aqueous or non-aqueous liquid. Once mixed, one or more additional components may be added to the slurry. These additional components may be added as solid metal salts, such as nitrates, acetates, oxalates, chlorides, halides, etc., or may be added as small metal or metal oxide particles. Once mixed, the slurry may be aged, if desired, or used directly in the manufacture of beads, particles, spheres, etc., or used to coat an inert ceramic substrate, such as a monolith. Following manufacture or coating of the inert ceramic substrate, the resulting material must be calcined at a temperature between 350 and 900°C (note column 4, lines 36-55). The calcination would convert the additional components into oxide forms if they are not already were.

Rossin '291 further discloses that the process is also applicable to the injection of gaseous or liquid phase perfluoroalkanes into a gas stream, including an oxidizing agent, such as air for example, and water (which would become steam at reaction temperature) (note column 5, lines 28-37 and column 3, lines 8-11). The "air" as disclosed in Rossin '291 is considered as a nitrogen-containing source as now required in the instant claims.

In Rossin '291, since Ni is specifically disclosed as one of the additional components that can be added to the aluminum oxide catalyst, thus, the disclosure of Rossin is considered as having "sufficient specificity" to include alumina-nickel oxide catalyst.

In any event, it would have been obvious to one skilled in the art to select any combination among the specifically disclosed compounds, i.e. nickel-aluminum oxide, *Merck & Co. Inc. v. Biocraft Laboratory Inc.* 10 USPQ 1846.

Rossin further discloses that if the concentration of hydrofluoric acid in the effluent stream is deemed unacceptable, conventional collection or abatement process, such as caustic scrubbing, may be employed to avoid venting acid gases directly into the atmosphere (note column 5, lines 44-48). The processes steps as required in the instant claims for removing HF from the exhaust gases are conventional and well known steps in the art.

For claim 79, Rossin discloses that perfluoroalkanes are released to the environment during certain industrial processes, such as during semiconductor manufacturing processes (note column 1, lines 21-30). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to treat any perfluoroalkanes which were released from any semiconductor manufacturing process, including when such perfluoroalkanes were used as etchants or cleaners for semiconductor processes.

Optionally, Imamura '985 is applied to teach that HF is a water-soluble component (note column 6, lines 48-49) and it can easily be removed by scrubbing with water (note claim 1). In Figure 1, the water scrubber comprises a nozzle 1e, which fairly teaches the "spray washing" of the gas with water to remove acidic gases.

Optionally, Okazaki '263 can also be applied to teach that acid compounds such as HCl, HF can be absorbed and neutralized by alkali (note column 4, lines 31-34).

Rossin discloses that the catalyst composition comprises aluminum oxide with the addition of between 0.01 and 50% of one or more elements selected from the group

consisting of nickel among others (note paragraph bridging columns 3-4). The composition of the catalyst recited in Rossin '291 is stated in weight percent and were calculated based upon the elements described. When the metal component or components were added by wet impregnation techniques, the weight percent of the metal(s) within the impregnation solution and the amount of impregnation solution used to prepare the catalyst. When the metal component or components were added to the aluminum oxide precursor slurried in water, the weight percent of the metal component(s) were calculated from the amount of aluminum oxide precursor and the amount of metal(s) present within the slurry, the weight loss upon ignition of the aluminum oxide precursor (note column 6, lines 1-15). Rossin does not specifically disclose the atomic ratio.

However, from the weight percent, one skilled in the art can calculate to figure out the atomic ratio. In Example IV, using 60g/mole as the molecular weight for the pseudoboemite "AlO(OH)", and 148.3 g/mole for the magnesium nitrate, the atomic ratio of Al:Mg is calculated to be out 49:1. In Example XIII, using 159 g/mole for the zirconium hydroxide and the atomic ratio of Al:Zr is calculated out to be about 2.65:1. These values are within the claimed range. Even though, Rossin '291 does not use nickel as the metal component in any of the Examples, however, one skilled in the art would have reasonably expected that the mole ratio of Al to Ni and any Zn would also be within the claimed range. Moreover, it would have been obvious to one of ordinary skill in the art to optimize the atomic ratio of aluminum to nickel based on the disclosed range stated above to obtain a catalyst best suited for transforming perfluoroalkanes.

In Example XIX, the conversion % at 750°C was 97.5% (note column 13), thus, Rossin '291 fairly teaches that the catalyst used can promote the decomposition of the fluorine compound at a decomposition rate of 97.4%. This value is well within the

claimed ranges. It should be noted that there is no minimum time requirement for “maintained”. The decomposition rate as disclosed in Rossin ‘291 is considered as being “maintained” at least long enough to achieve such rate.

The difference is Rossin ‘291 does not teach the step of adding a hydrocarbon to the gas stream.

Nguyen ‘041 discloses a process a treating a gas stream containing compounds selected from the group consisting of halogenated organic compounds, other organic compounds and mixture thereof, comprising contacting said gas stream with a catalyst in the presence of an effective amount of oxygen and water (note claim 1). Nguyen ‘041 teaches that the gas stream to be treated contain water vapor so that haloacids are formed instead of molecular halogen compounds because (1) an acid is much more easily trapped and neutralized from the effluent gas stream than a molecular compound thereby reducing corrosion problems in downstream process equipment and (2), molecular halogen compounds can attack the components of the catalyst much more easily than haloacids, thereby decreasing the life of the catalyst (note column 7, lines 38-49).

Nguyen ‘041 further discloses that one method of providing the needed water to a dry gas stream is to add a hydrocarbon or other organic compound, e.g., ethylene, propylene, methanol, etc. if these are not already in the waste gas streams which then are combusted over the catalyst to carbon dioxide and water. The amount of such organic compound is chosen so that the ratio of total hydrogen from all sources in the gas stream entering the catalyst reactor to total halogen atoms is at least 1:1 or greater. Additionally, if the gas stream does not contain oxygen (air), it must be added to carry out the combustion (note paragraph bridging columns 7 and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add a hydrocarbon to the effluent gas stream containing perfluoroalkanes in the process of Rossin '291, as suggested by Nguyen '041 because such hydrocarbon will combust over the catalyst to form carbon dioxide and water to provide the required water for the formation of HF as disclosed in Rossin '291.

Claims 44, 50, 87-89 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rossin '291 and Nguyen '041, optionally further in view of Imamura '985 or Okazaki '263 as applied to claims 40-43, 45-49, 51, 79-86 above, and further in view of Rosenbaum (5,460,792).

The difference not yet discussed is Rossin '792 does not disclose the addition of zinc oxide.

Rosenbaum '792 discloses a process for the destruction of hydrocarbon compounds, which uses a catalyst comprising a carbonaceous pyrolyzed resinous polymer. The catalyst is doped with a compound selected from the group consisting of metal oxides, metal oxyhalides or precursor metal salts wherein the metal of the metal oxides, metal oxyhalides and precursor metal salts is selected from the group consisting of Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Co, Zn, Pd, Nb, Zr, Mo and mixtures thereof (note claim 1). Rosenbaum '792 further discloses that the process can be used for the destruction of organic compounds, which refer to either halogenated organic, or hydrocarbon compounds or mixture thereof (note column 4, lines 15-18). Exemplified compounds, which can be destroyed, are C_2Cl_4 , CCl_4 (note column 16, lines 6 and 9), Rosenbaum '792 teaches that the halide can be any halide, while chlorine and bromine are being preferred (note column 7, lines 28-26). Rosenbaum '792 further disclose that the compounds for the dopants can be precursors which form the metal oxide or metal

oxyhalide, typically be hydrolysis or decomposition, such as nitrate, sulfate, etc. (note column 14, lines 3-19). When a sulfate is used, there would be some sulfur in the final catalyst product as required in the instant claims.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to further include zinc in the catalyst of Rossin '792 because Rosenbaum '792 suggests that zinc, just as nickel, would promote the destruction of the halogenated hydrocarbon.

Applicant's arguments filed April 9, 2008 have been fully considered but they are not persuasive.

Applicants alleged that the addition of nitrogen gas provides a number of benefits.

There is no evidence on record to support the alleged benefits. The only clear disclosure in Applicants' specification is the nitrogen is used to dilute the gas containing the fluorine compound (note page 15, lines 22-24 and page 39, lines 13-14). The same diluting effect can be achieved by using the air, i.e. a nitrogen containing gas, as disclosed in Rossin '291. It should be noted that Applicants' claims do not exclude the presence of oxygen (as in the "air" disclosed in Rossin '291), especially now that Applicants' claims require the addition of a hydrocarbon to the gas stream because "hydrocarbons can be *combusted* on the catalyst" (note Applicants' specification, page 13, lines 6-10) and oxygen is required for the combustion of the hydrocarbon.

Applicants argue that Rossin '291 relates to a reactive process that takes place in the presence of air; thus, Rossin fails to teach or suggest each and every limitation of the present claims.

It should be noted that Applicants' claimed process can also takes place in the presence of air because Applicants' claims require that "adding ... steam and oxygen to the gas stream" and the oxygen in this step and the nitrogen required in the previous step would render an atmosphere similar if not the same as the air disclosed in Rossin '291.

Applicants argue that Rossin '291 proceeds in a series of steps that prevent the desired outcome of reducing the likelihood of oxidative decomposition.

In Rossin '291, since the process is carried out in the presence of water, at least some "hydrolysis" would occur, and Applicants' claims do not exclude the "oxidative decomposition" as long as the perfluorocarbon is decomposed into HF and other byproducts.

Applicants argue that the secondary references do not make up for the failure of Rossin '291.

The secondary references are applied as stated in the above rejections and maintained for the same reasons above.

The rejection of claims 44, 50, 87-89 over Rossin '291, in view of Inamura or Okazaki and further in view of Rosenbaum is also maintained for the reasons stated above.

Applicants request reconsideration of the previously submitted of unexpected superior results the Al/Ni catalysts were superior in terms of achieving a high reduction rate when the starting CF concentration was 5000 ppm or higher and maintaining the high reduction rate for the longer of time than catalysts containing other elements.

As pointed out in the previous action, Figure 6 is only for decomposing C_2F_6 , the highest decomposition rate (about 96%) is for an Al/Zn not Al/Ni catalyst. Furthermore, as shown in Rossin '291, the decomposition rate of CF_4 (which is a C-F compound as required in Applicants' claims) is 97.4% (note Table for Example XIX) for Al/Zr catalyst. This rate is even higher than the highest decomposition rate shown in the Figure 6. It should be also be noted that Applicants' claims are not limited to C-F concentration of "5000 ppm or higher" and there is no duration required for the claimed process. Thus, the data in Figure 6 and the two Kanno declarations are not sufficient to overcome the outstanding rejections.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ngoc-Yen M. Nguyen whose telephone number is (571) 272-1356. The examiner can normally be reached on Part time schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/
Primary Examiner, Art Unit 1793

nmn
July 22, 2008